

MBUS-GE20M/GE80M - USER MANUAL

MBUS-GE20M/GE80M GATEWAY FOR SMART METERING

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1 General hints and conventions

1.1 About this document

This manual provides guidance and procedures for a fast and efficient installation and start-up of the units described in this manual. It is imperative to read and carefully follow the safety guidelines.

1.2 Legal bases

1.2.1 Copyright

This manual, including all figures and illustrations, is copyright-protected. Any further use of this manual by third parties that violate pertinent copyright provisions is prohibited. Reproduction, translation, electronic and phototechnical filing/archiving (e.g. photocopying) as well as any amendments require the written consent of solvimus GmbH.

Non-observance will involve the right to assert damage claims.

The solvimus GmbH reserves the right to provide for any alterations or modifications that serve to increase the efficiency of technical progress. All rights arising from the granting of patents or from the legal protection of utility patents are owned by the solvimus GmbH. Third-party products are always mentioned without any reference to patent rights. Thus, the existence of such rights cannot be excluded.

1.2.2 Personnel qualifications

The use of the product described in this manual requires special personnel qualifications. All responsible persons have to familiarize themselves with the underlying legal standards to be applied, i. e.:

- Valid standards
- Handling of electronic devices






The solvimus GmbH does not assume any liability whatsoever resulting from improper handling and damage incurred to both, solvimus own and third-party products, by disregarding detailed information in this manual.

1.2.3 Technical condition of specified devices

The supplied components are equipped with hardware and software configurations, which meet the individual application requirements. Changes in hardware, software and firmware are permitted exclusively within the framework of the various alternatives that are documented in the specific manuals. The solvimus GmbH will be exempted from any liability in case of changes in hardware or software as well as to non-compliant usage of components.

Please send your request for modified and new hardware or software configurations directly to the solvimus GmbH.

1.3 Symbols

-  Danger: Always observe this information to protect persons from injury.
-  Warning: Always observe this information to prevent damage to the device.
-  Attention: Marginal conditions that must always be observed to ensure smooth and efficient operation
-  ESD (Electrostatic Discharge): Warning of damage to the components through electrostatic discharge. Observe the precautionary measure for handling components at risk of electrostatic discharge.
-  Note: Make important notes that are to be complied with so that a trouble-free and efficient device operation can be guaranteed.

- ➔ Additional informations: References to additional literature, manuals, data sheets and internet pages.

1.4 Font conventions

Names of paths and data files are marked in italic-type. According to the system, Slashes or Backslashes are used.

i. e.: *D:\Data*

Menu items are marked in italic-type, bold letters.

i. e.: ***Save***

Sub-menu items or navigation steps within a web browser are marked by using an arrow between two menu items or tabs.

i. e.: ***File*** → ***New***

Pushbuttons or input fields are marked with bold letters.

i. e.: **Input**

Keys are marked with bold capital letters within angle brackets.

i. e.: <**F5**>

The print font for program codes is Courier.

i. e.: END_VAR

Names of variables, designators and configuration fields are marked in italic-type.

i. e.: *Value*

1.5 Number notation

Numbers are noted according to this table:

Number code	Example	Note
Decimal	100	Normal notation
Hexadecimal	0x64	C Notation
Binary	'100'	in quotation marks
	'0110.0100'	nibbles separated with dot

Table 1: Numbering systems

1.6 Safety guidelines

- ⚠ All power sources to the device must always be switched off before carrying out any installation, repair or maintenance work.



Replace defective or damaged devices/modules (i. e. in the event of deformed contacts), as the functionality of the devices cannot be ensured on a long-term basis.

The components are not resistant against materials having seeping and insulating characteristics. Materials like e.g. aerosols, silicones, triglycerides (found in some hand creams) belong to this group.

If it cannot be ruled out that these materials appear in the component environment, then the components must be installed in an enclosure that is resistant against the above mentioned materials.

Clean tools and materials are generally required to operate the device/module.

- ⚠ Only use a soft, wet cloth for cleaning. Soapy water is allowed. Pay attention to ESD.
- ⚠ Do not use solvents like alcohol, acetone etc. for cleaning.
- ⚠ Do not use contact sprays, which could possibly impair the functioning of the contact area and may cause short circuits.

-  Components, especially OEM modules, are designed for the mounting into electronic housings. Those devices shall not be touched when powered or while in actual operation. The valid standards and guidelines applicable for the installation of switch cabinets shall be adhered to.
-  The devices are equipped with electronic components that may be destroyed by electrostatic discharge when touched. It is necessary to provide good grounding to personnel, working environment and packing. Electroconductive parts and contacts should not be touched.

1.7 Scope

This manual describes the devices mentioned in the title, supplied by solvimus GmbH, Ilmenau.

1.8 Abbreviations

Abbreviation	Description
CSV	Character-Separated Values
DNS	Domain Name System
DI	Digital Input
DO	Digital Output
DIN	Deutsches Institut für Normung, German standardization body
DLDE	Direct Local Data Exchange (EN 62056-21, IEC 1107)
DLDE RS	DLDE communication via RS-232 or RS-485
DLMS	Device Language Message Specification
I/O	In- / Output
ESD	ElectroStatic Discharge
FNN	Forum Netztechnik/Netzbetrieb, forum network technology / network operation (committee of VDE)
FTP	File-Transfer Protocol
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HTTP	Hypertext Transfer Protocol
ID	Identification, Identifier
IP	Internet Protocol or. IP address
LED	Light-Emitting Diode
M-Bus	Meter-Bus (EN 13757, part 2 - 3)
MAC	Medium Access Control or MAC address
MUC	Multi Utility Communication, MUC-Controller
OEM	Original Equipment Manufacturer
PEM	Privacy Enhanced Mail
PPP	Point-to-Point Protocol
PPPoE	Point-to-Point Protocol over Ethernet
RFC	Requests For Comments
RSSI	Received Signal Strength Indicator
RTC	Real Time Clock
RTOS	Real Time Operating System
S0	S0 interface (pulse interface, EN 62053-31)
SIM	Subscriber Identity Module
SML	Smart Message Language
SMTP	Simple Mail Transfer Protocol
SNTP	Simple Network Time Protocol
TCP	Transmission Control Protocol
TLS	Transport Layer Security
UTC	Coordinated Universal Time
VDE	Verband der Elektrotechnik Elektronik Informationstechnik e.V., association for electrical, electronic & information technologies
WAN	Wide Area Network
wM-Bus	Wireless Meter-Bus (EN 13757, part 3 - 4)
XML	eXtensible Markup Language

Table 2: Abbreviations

1.9 Versions

Version	Date	Editor	Changes
1.00	18.11.2013	Sebastian Bauer	Initial release for software version 1.10
1.20	18.11.2014	Sven Ladegast	Necessary changes for software version 1.20
1.20a	20.11.2014	Sven Ladegast	Synchronized with German version of this manual

Table 3: Versions of this document

2 General Information

The M-Bus (Meter-Bus) is an established and well known interface for automated meter reading. Especially the ease of installation (simple two-wire system with powering by the bus) and the robustness are important features. These are also special attributes that are of interest for use in industrial environments.

The M-Bus is defined in the standard EN 13757. There is an own physical layer as well as an own protocol. For connecting it to other systems a translation is necessary.

In the field of automation Modbus TCP is one of the most common communication standards. Bringing these two worlds, the M-Bus and the Modbus TCP, together, gateways are needed. The products MBUS-GE20M and MBUS-GE80M (hereafter called MBUS-GEM) are such gateways allowing the direct transmission of meter data to a control system (PLC, DDC etc.).

The device supports operating 20 or 80 meters (standard loads) at the M-Bus. A powerful protocol stack is implemented. It handles the complete data handling on the MBUS-GEM compliant to the standard. All the available meters on the market can be read out and processed without further manual configuration. The meter data is available for other systems without effort.

The MBUS-GEM serves as a Modbus TCP slave device (Modbus TCP server) via its Ethernet port. The PLC as a Modbus master (Modbus TCP client) can access directly the meter data via a network connection. The data is available in different Modbus registers.

The MBUS-GEM gateway reads out the meters autonomously. That is why an initial configuration of the device is necessary. The built-in configuration website eases this process. Via this website all of the functionality is available to the user. In addition to the basic system configuration, values can be selected to be available via Modbus, M-Bus scans can be performed and the current data is reported. In this way, remote control or remote service is also possible.

The MBUS-GEM comes in a 2U enclosure (modules) and is intended for DIN rail mounting (standard 35 mm DIN rail).

2.1 Device variants

The MBUS-GEM is a modular designed gateway. As different variants are available it is possible to use the configuration which fits best to the application.

Variant	Order number	M-Bus interface
MBUS-GE20M	500337	Max. 20 standard loads
MBUS-GE80M	500338	Max. 80 standard loads

Table 4: Available variants

2.2 Connectors

The interfaces and connectors of the MBUS-GEM are available on different sides of the device.

The following pictures show the device:



Figure 1: MBUS-GE20M

The MBUS-GEM is equipped with following connectors:

Connector	Marking	Pinning	Remark
Power supply	24VDC, GND	24VDC: positive power supply GND: negative power supply	24 VDC ($\pm 5\%$), Screw clamp Cross sectional area 2,5 mm ²
M-Bus connectors	MBUS+, MBUS-	MBUS+: positive bus line (2x) MBUS-: negative bus line (2x)	Screw clamp Cross sectional area 2,5 mm ² MBUS+ and MBUS- are shorted each
Ethernet interface	Ethernet	1: TX+ 2: TX- 3: RX+) 4: 5: 6: RX- 7: 8:	According to TIA-568A/B

Table 5: Connectors and interfaces

3 Bringing into service

The MBUS-GEM boots automatically after connecting to the supply voltage. By default, following calls are made on system startup:

- Configuration of the network interface (Ethernet) via DHCP or static configuration
- Providing a Ramdrive as drive C:
- Obtaining the system time via SNTP
- Start of the main program

The main program provides the entire functionality, including the web interface of MBUS-GEM.

3.1 Network configuration and first steps

The MBUS-GEM is fully configurable via the ethernet network interface. This must therefore be configured according to your network. If unsure, please ask your network administrator.

- ✓ The MBUS GEM is configured for having the static IP address 192.168.1.101 (subnet mask: 255.255.255.0, gateway: 192.168.1.254) per default.

The network settings can be configured via the website. There is the tab **General** (see section: 4.1) for configuration of these parameters.

- ➔ Website on the MBUS-GEM, i.e.: <http://192.168.1.101/>

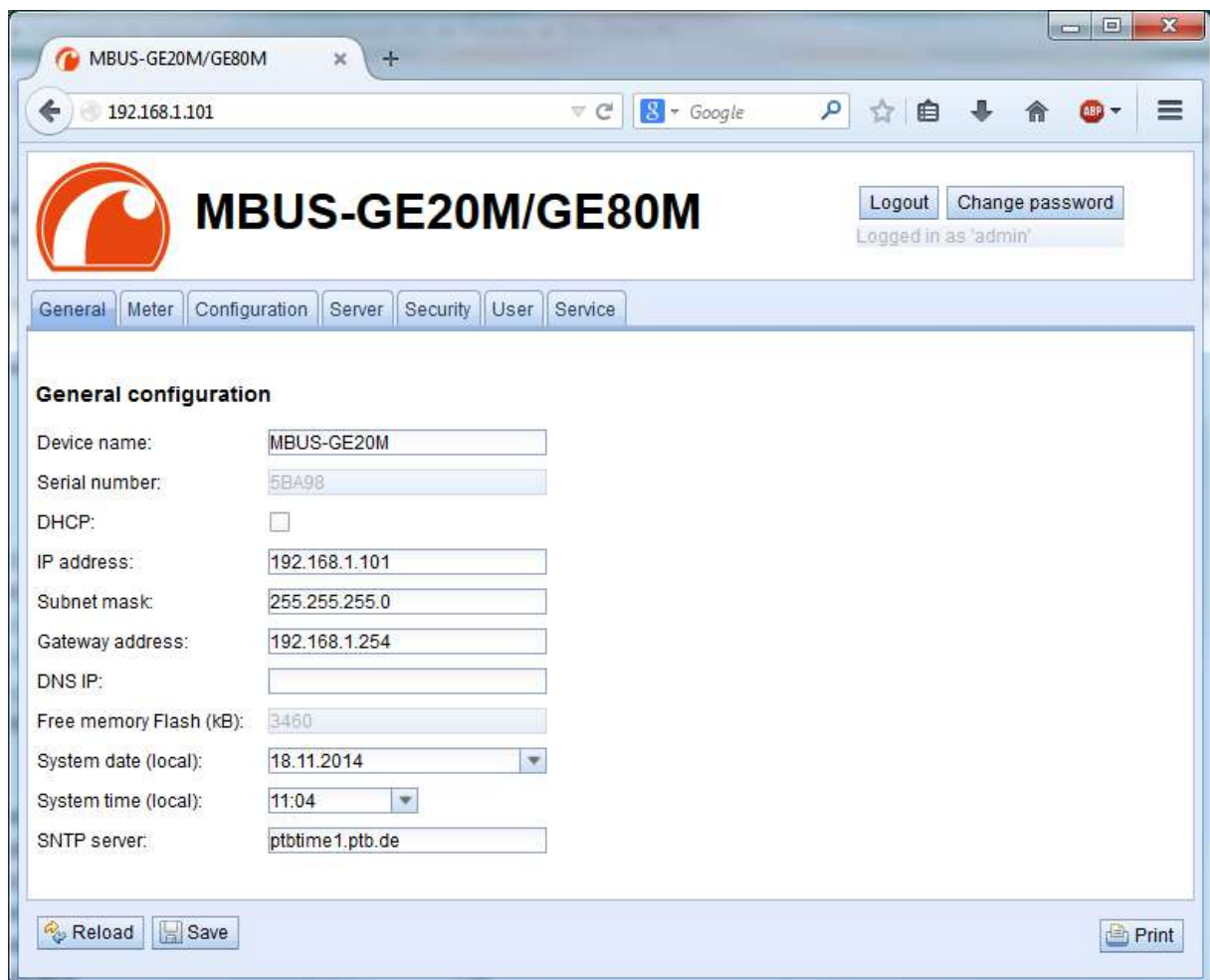


Figure 2: MBUS-GEM website

If a direct connection using the pre-configured network configuration is not possible or you can not connect for any other reason, it is recommended to use the "CHIPtool" of Beck IPC GmbH.

- ➔ http://www.beck-ipc.com/de/download/licence.asp?id=chiptool_install&l=1

- Search at: <http://www.beck-ipc.com> → DOWNLOAD CENTER → Quick Search "chiptool" → Software: "CHIPTool version xxxx"

After installing and starting the tool, the main window comes up with all accessible devices in the local network. A right-click on an entry in the device list opens a context menu. There are functions like IP configuration, HTTP or FTP access. Some important features are described in detail in the subsequent subsections.

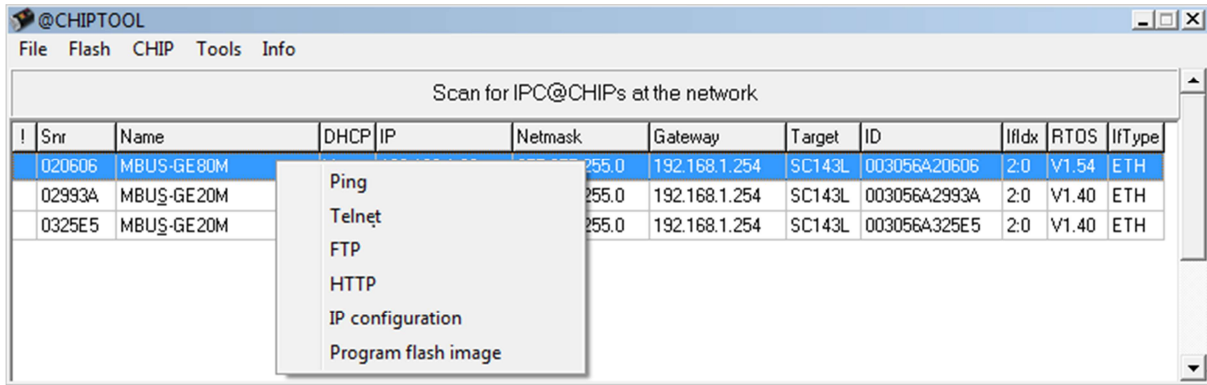


Figure 3: CHIPTool with a list of all available MBUS-GEM in the local network

3.1.1 Network parameters

Using the command **IP configuration** in the context menu the network configuration (IP address, DHCP, etc.) of the device can be changed. The parameters shall be configured according to the current network. This data is then stored as a static configuration on the device.

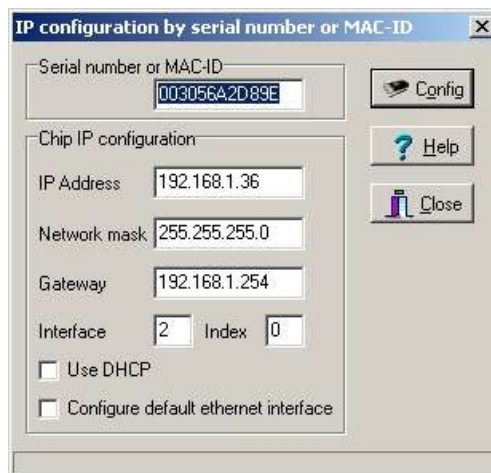


Figure 4: Network configuration with CHIPTool

The configuration is completed by pushing the button **Config**. A window appears which requires the administrator password.

If the automatic network configuration (DHCP) is enabled in the MBUS - GEM, all parameters (IP address, Subnet mask, gateway, etc.) will be obtained from a DHCP server. The assigned IP address can be determined from the DHCP server based on the unique MAC address of the MBUS - GEM. This is defined like in the following example:

MAC: 00-30-56-Ax-xx-xx Last 5 digits are the serial number.
 Example: 00-30-56-A3-25-E5 Serial number: 00325E5.

If it is not possible to automatically configure your network (DHCP), the unit will choose a standard IP address (169.254.xxx.xxx) according to RFC3927.

- ❗ The default password is contained in section 4.7.
- ❗ Changing the network parameters of the MBUS-GEM may restrict the accessibility. If the network parameters have been correctly set by an administrator, these shall not be changed.

3.1.2 Connectivity test (ping)

The **Ping** command in the context menu can be used for testing the connectivity. Using a standard ping call through Windows (command line), it is checked whether the MBUS-GEM answers correctly:

Example output: Reply from 192.168.1.23: Bytes = 32 Time <1ms TTL = 255

3.1.3 Web access (HTTP)

The website of the device is opened in the browser via the **HTTP** command in the context menu. This command refers directly to the configured default browser. That website can also be accessed directly with a browser by entering the address of the device. More information regarding the website of MBUS-GEM can be found in section 4.

3.1.4 File access (FTP)

A FTP connection to the selected MBUS-GEM is established via the **FTP** command in the context menu.

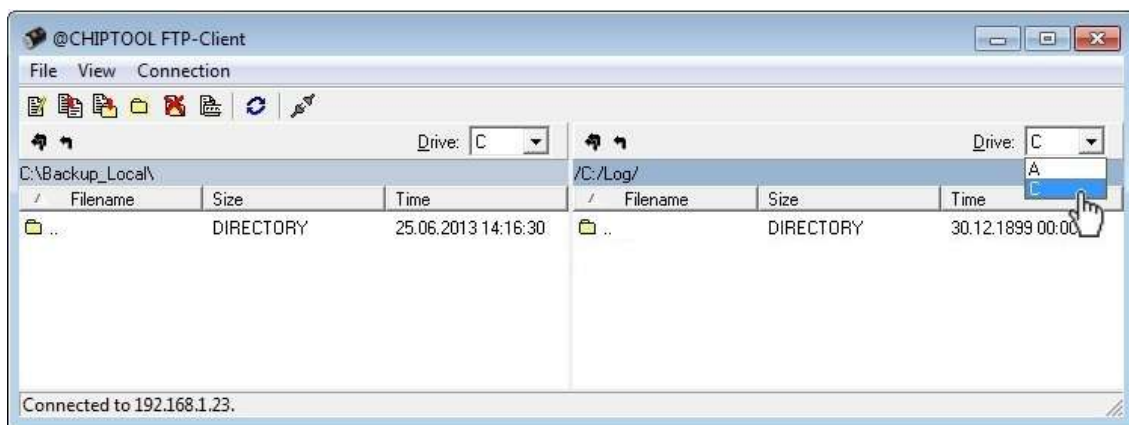


Figure 5: FTP client of CHIPTool

The FTP client shows a simple file view. Using the context menu file commands can be executed (e. g. copying, renaming or editing). The two drives of the MBUS-GEM (A: or C:) can be selected in the upper right of each file view.



- ❗ The standard log-in credentials are contained in section 4.7.
- ⚠ Only trained personnel are allowed to change the files and the file system, since this may restrict the functionality of the device.

4 Configuration

The MBUS-GEM is configured via its internal website. Alternatively, configuration can be done manually by using the configuration files (see section: 8.4)

The website allows reviewing and changing of device parameters, meter configuration and also services.

On delivery, the website automatically logs on with standard log-in data. If the standard user is already disabled in the configuration, correct login data must be entered.

-  In order to switch to another user, please select the logout button at the upper right.
-  The standard log-in credentials are contained in section 4.7.



The login dialog box has a title bar 'Login'. It contains two input fields: 'Username:' with the value 'admin' and 'Password:' with masked characters '.....'. Below the fields are two buttons: 'Login' and 'Default Login'.

Figure 6: Login dialog

Users with write access should always log out after finishing the configuration, because no other user is allowed to have write access at the same time. If the connection stays active, no write access is available anymore.

4.1 Tab General

The tab **General** shows a general overview on the MBUS-GEM. Following values can be reviewed and changed:



The 'General' tab is selected in the top navigation bar. The 'General configuration' section contains the following fields:

- Device name: MBUS-GE80M
- Serial number: 20606
- DHCP: ☒
- IP address: 192.168.1.23
- Subnet mask: 255.255.255.0
- Gateway address: 192.168.1.254
- DNS IP: (empty)
- Free Memory Flash (kB): 4204
- System date (local): 2013-07-10
- System time (local): 17:40
- SNTP server: ptbtime1.ptb.de

At the bottom are 'Reload' and 'Save' buttons.

Figure 7: Tab General

Field name	Description	Write access
Device name	Name of device (correlates to CHiPtool)	yes
Serial number	Serial number of device	no
DHCP	Activates automatic network configuration	yes
IP address	IP address of device	yes
Subnet mask	Subnet mask of device	yes
Gateway address	Gateway address	yes
DNS IP	IP address of DNS server*	yes
Free Memory Flash (kB)	Free storage space on internal memory of the controller	no




Field name	Description	Write access
System date (local)	Current local system date	yes
System time (local)	Current local system time	yes
SNTP Server	Address of time server	yes

*On obtaining the DNS server via DHCP, this value is not shown on the website.

Table 6: Fields in tab General

The button **Save** finally saves the configuration. On **Reload** the last saved values are loaded and current changes get lost.

If the network configuration has been changed, the MBUS-GEM will be available under the new IP address after storing these changes. All established network connections to the device will be terminated and logged in users will be logged out automatically.

-  Changing the network parameters of the MBUS-GEM may restrict the accessibility. If the network parameters have been correctly set by an administrator, these shall not be changed.
-  By storing the parameters via the button Save the MBUS-GEM is automatically reinitialized.
-  In MBUS-GEM date and time are always processed as UTC time (without time zone shift). On the website, the web browser converts these according to the local time zone of the computer. For example the Central European Time or Central European Summer Time is used in Central Europe. If the web browser uses a different time zone, the time is displayed accordingly.

4.2 Tab Meter

The tab **Meter** displays a list of the connected meters and gives the user the ability to search for them, manually create new meters or edit already existent meters.

The meter view displays the following information:









General Meter Configuration Server Security User Service													
Connected meters													
Interface	S	Serial	MAN	Medium	Version	Link	Value	Scale	Unit	Cycle	User label	Description	Register
 M-Bus	*	00023872	EMU	Electricity	16	0				0			10
 M-Bus		00389851	EMH	Electricity	10	7				0			220
---							25 541	1E+0	h			On time	230
---							29 298	1E+1	Wh			Energy	240
---							4	1E+0	W			Power	250
---							542	1E+0	None			Reset counter	260
---							4	1E+0	Bin			Error flags (Device type specific)	270
---							No Data	1E+0	None			None [1]	280
 M-Bus		00000028	WEP	Electricity	1	0				0			0
 M-Bus		92710335	ELS	Valve (gas or water)	89	0				0			0
 M-Bus		70125236	PIK	Electricity	2	0				0			0
 M-Bus		00000098	CGC	Heat cost allocator	85	0				0			0
 M-Bus		35300749	HYD	Communicati controller	57	235				0			0
 M-Bus		14677789	KAM	Electricity	1	65				0			0
---							368 100	1E+0	Wh			Energy (Forward flow only)	0
---							0	1E+0	Wh			Energy (Backward flow only)	0
---							368 108	1E+0	None			Special supplier information	0
---							0	1E+0	None			Special supplier information	0

Figure 8: Tab Meter

Field name	Description	Write access
Interface	Interface of meter (M-Bus)	no
Serial	Serial number of meter (number of meter)	no

Field name	Description	Write access
MAN	Manufacturer of meter (abbreviation)	no
Medium	Medium of meter, according to column 2 of Table 17: Medium types in section 6.2.1	no
Version	Version number of meter	no
Value	Meter reading or measurement value	no
Scale	Scale factor (scientific notation)	no
Unit	Unit, according to column 2 of Table 19: Units in section 6.2.1	no
Cycle	Readout interval in seconds (entering 0 means using the general readout interval)	yes
User label	User specific description of meter value, included in export of CSV data, allows application specific mapping – valid characters are: A-Z, a-z, 0-9, !, \$, %, &, /, (,), =, ?, + and * comma is also allowed, not allowed are: <, > und " "	yes
Description	Description of meter value, according to column 2 of Table 18: Measurement types in section 6.2.1	no
Register	Modbus register address, in steps of 10 (see section: 6.2.2)	yes

Table 7: Fields in tab Meter

The meter configuration can be changed with the buttons in the bottom area of the website or the context menu by right-clicking a meter entry. Meters entries or meter value entries can, according to the limitations of the used interface (M-Bus), be automatically searched, created, deleted or edited.

Meter entries and meter value entries can be selected with a single mouse click. Multiple selections are possible by holding the **SHIFT** key (selecting ranges) or holding the **CTRL** key (multiple selections by clicking).

On activating or deactivating a meter, its meter values are automatically enabled or disabled according to the hierarchy. If a meter is not active, it is also activated by activating one of its meter values.

On **Reload** the last saved values are loaded and current changes get lost. The meter values are updated accordingly. On delivery the meter list of the MBUS-GEM is empty. If meters connected to the MBUS-GEM, an M-Bus scan can be started by pressing the **Scan** button. The scan mode is configured in the tab **Configuration**. For more detailed information please see section 6.1.1.

- ✓ Depending on the mode and number of connected meters, this process can take a long time.

The scan process cannot be interrupted. The meter configuration is applied immediately after scanning. Only additional changes must be saved manually. The meter list is additively expanded during the scan, already existing meters will not be deleted, even if those are not available anymore.

- ✓ Regarding M-Bus meters, the arrangement of data in the table of tab Meters corresponds to the order of the data in the M-Bus protocol. Thus, the meaning of the values can be compared directly with the data sheet of the meter. Alternatively it is possible to assign the meter values to the raw data of the meter (see parameter Description mode on the tab Configuration, see section 4.3).
- ✓ Timestamps transmitted within the M-Bus protocol, are automatically assigned to the other meter values if possible. Therefore, some of these do not appear in the table. The configuration parameter MUC_SHOWTIMESTAMPENTRIES does offer the possibility to manually enable the display of all time stamps (see section 8.4.1).
- ⚠ If a scan or a change at the meter list is terminated with the error message: "Webserver capacity exceeded", please take note of the hints in section 7.3.6.
- ℹ By releasing firmware version 1.20 the definition of some measurement types have been extended.
- ℹ Descriptions of meter value entries that showed as Reserved with firmware versions earlier than 1.20 will be still shown as Reserved for compatibility reasons. If the new measurement types shall be displayed the meter needs to be deleted and newly created at the meter list (e. g. with an M-Bus scan).

Meters that are not found during a scan or that does not support an automated scan can be added manually to the meter list using the button **Add** or using the context menu entry **Add meter**. More information about manually adding meters can be found in section 6.1.2.

By double-click an entry or using the context menu entry **Edit** it is possible to configure the meter or value entry. All fields in this configuration dialog correlate with the fields in the meter list (see Table 7: Fields in tab Meter). According to the used interface several fields can be enabled or disabled for editing.

Within the configuration for an entry it is possible to set user labels for each value entry to have an application-specific assignment of the meter and the meter values. It is also possible to set the readout interval (parameter Cycle) independently for every meter.

Register addresses for the Modbus transmission can be assigned or reset for one or all meters by pressing the buttons **Allocate** and **Deallocate**. During saving the configuration the Modbus addresses will be checked for duplicates. If duplicate addresses are detected an error message will pop up.

The button **Delete** opens a window allowing deletion of selected entries of the meter list.

✔ The deletion of single meter value entries is not possible.

Push the button **Save** for saving all changed parameters.

The button **Readout** triggers a read-out of connected meters regardless of the readout cycle. The spontaneous readout may take some time depending on the number of connected meters. All additionally read data is also available to the server communication. The global readout interval is unaffected by this process.

4.3 Tab Configuration

The tab **Configuration** allows configuring the meter interface of MBUS-GEM. The following parameters are available:

Figure 9: Tab Configuration

Field name	Description	Write access
Readout interval (s)	Standard readout cycle of meters (in seconds). Value might be overwritten for each meter by parameter Cycle in tab Meter	yes

Field name	Description	Write access
Description mode	<p>Mode of displaying the meter value description on the website:</p> <ul style="list-style-type: none"> - None: No display of description - Standard: Display of common value description - Extended: Extended display of value description (parameters will be displayed if they differ from 0): Notation: Description [Memory No.] <Tariff> {min max error} Example: Energy [2] <1> {max} - Extended with DIF/VIF: Extended display including DIF and VIF raw data Notation: Description [Memory No.] <Tariff> {Value Type} # XX XX XX ... Example: Energy [2] <1> # 8C 11 04 - Extended with raw data: Extended display including the raw data of the complete meter value entry. Notation corresponds to Extended with DIF/VIF: Example: Energy [2] <1> # 8C 11 04 96 47 06 00 - DIF/VIF: Display of DIF/VIF raw data - Raw data: Displays the raw data of the complete meter value entry <p>After changing this parameter, a readout is needed to update the meter list and to display the relevant data.</p>	Yes
Maximum device count	Limitation of the number of meters to scan. (0: no limitation). Already configured meters are not limited by this parameter.	Yes
Maximum value count	Limitation of the number of meter value entries to read during a readout (0: no limitation). Already configured meter value entries are not limited by this parameter.	Yes
RAW log active	Activates the raw data log.	Yes
M-Bus mode	M-Bus scan mode (secondary, reverse secondary or primary search)	Yes
Primary start address	First address for primary search	Yes
Primary final address	Last address for primary search	Yes
Secondary address mask	Search mask for secondary search, 8 numerical characters; „F“ defines a wildcard; missing characters will be filled up with leading zeros	Yes
M-Bus baud rate	Baudrate for M-Bus communication (300-19200 baud)	Yes
M-Bus timeout	M-Bus timeout until reception of first data (in ms)	Yes
M-Bus idle timeout	M-Bus timeout until end of reception (in ms)	Yes
M-Bus full timeout	M-Bus timeout (complete) for reception of a whole data packet (in ms)	Yes
M-Bus request mode	<p>Mode of the M-Bus readout (REQ_UD2):</p> <ul style="list-style-type: none"> - Standard: Readout with REQ_UD2 - Extended 1: Readout with Get-All-Data (DIF/VIF 7F 7E) and REQ_UD2 - Extended 2: Readout with Get-All-Data (DIF 7F) and REQ_UD2 	Yes
M-Bus reset mode	<p>Mode of the M-Bus Reset (before scan and readout):</p> <ul style="list-style-type: none"> - None: no reset - Standard: Send SND_NKE to primary address of the meter or broadcast address when using secondary addressing - Extended 1: Send SND_NKE to primary address FD and SND_NKE to primary address of the meter or broadcast address when using secondary addressing - Extended 2: Send SND_NKE and an Application Reset to primary address FD and a SND_NKE to the primary address of the meter or to broadcast address when using secondary addressing. 	Yes
M-Bus max. multipage	Limits the count of multipage requests	Yes

Table 8: Fields in tab Configuration

The button **Save** finally saves the configuration. On **Reload** the last saved values are loaded and current changes get lost.

 By storing the parameters via the button **Save** the MBUS-GEM is automatically reinitialized.

4.4 Tab Server

The tab **Server** allows configuring the Modbus TCP interface of MBUS-GEM. The following parameters are available:

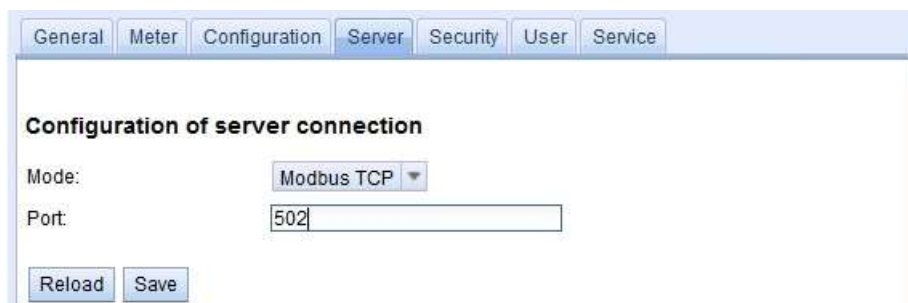


Figure 10: Tab Server

Field name	Description	Write access
Mode	Mode Modbus TCP	yes
Port	Port number to which the remote station (Modbus TCP client) shall connect	yes

Table 9: Fields in tab Server

The button **Save** finally saves the configuration. On **Reload** the last saved values are loaded and current changes get lost.

 By storing the parameters via the button **Save** the MBUS-GEM is automatically reinitialized.

4.5 Tab Security

The tab **Security** allows configuring the network services (FTP, Telnet) of MBUS-GEM. Following parameters are available:



Figure 11: Tab Server

Field name	Description	Write access
FTP Server active	Activates internal FTP server of MBUS-GEM, if deactivated, there is no FTP access available at all	yes
Telnet Server active	Activates internal Telnet server of MBUS-GEM (root access with admin credentials)	yes

Table 10: Fields in tab Security

The button **Save** finally saves the configuration. On **Reload** the last saved values are loaded and current changes get lost.

 By storing the parameters via the button **Save** the MBUS-GEM is automatically reinitialized.

4.6 Tab Service

The tab **Service** allows maintenance service and provides related informations:



Figure 12 Tab Service

Field name	Description	Write access
Hardware version	Version of hardware	no
RTOS version	Version of operating system	no
Software version	Version of software	no
Website version	Version of website	no

Table 11: Fields in tab Service

On **Reload** the values are updated.

The button **Reboot** restarts the MBUS-GEM. All internal processes are shut down and reinitialized after the reboot.

4.7 Tab User

In the tab **User**, different users can be managed and provided with specific access rights. The following users are pre-configured on delivery:

User name	Password	Remark
admin	admin	Administrator user with root access, allows full access to all services of MBUS-GEM (HTTP, FTP, flash update, IP configuration)
web	web	Default user for the web interface - if there is a user with this name and password, the web interface automatically logs in with these credentials, otherwise, the user is prompted to enter the credentials, this user has full access to the website of MBUS-GEM on delivery
ftp	ftp	User for FTP access to the log directory C:/log/

Table 12: Predefined users on delivery

The existing configuration in the user table can be changed via the website:

Figure 13: Tab User

Field name	Description	Write access
Name	User name	no
Password	Password	yes
Change Password	If active, user is allowed to change its password	yes
Sessions	Number of open session with this user account	no
MaxSessions	Limit for the number of simultaneous user sessions (-1=unlimited)	yes
Read General	Read access for tab General	yes
Write General	Write access for tab General	yes
Read Meter	Read access for tab Meter	yes
Write Meter	Write access for tab Meter	yes
Read Config	Read access for tab Configuration	yes
Write Config	Write access for tab Configuration	yes
Read Server	Read access for tab Server	yes
Write Server	Write access for tab Server	yes
Read Security	Read access for tab Security	yes
Write Security	Write access for tab Security	yes
Read Service	Read access for tab Service	yes
Write Service	Write access for tab Service	yes
FTP	User is allowed to access the FTP server (maximum 2 users)	no
Write User	Read/Write access for tab User	yes

Table 13: Fields in tab User

The user configuration can be changed by the buttons at the bottom area or by using the context menu by right-clicking on the user's entry. With exception of the user *admin*, users can be created, edited or deleted.

User entries are selectable by mouse clicks. By pressing the **SHIFT** key it is possible to select a range of user entries and by pressing the **CTRL** key it is possible to select multiple user entries one by one.

By pressing the **Reload** button, all changes will be discarded and the last saved settings will be restored.

Having write access for a tab, will automatically provide read access to this tab.

- ⚠ The user *admin* cannot be changed or deleted via the general user configuration. Its password can only be changed via the button Change password by the logged in admin user itself.
- ⚠ On losing the administrator password, MBUS-GEM can only be reset by a service engineer of solvimus GmbH, file access to files on the MBUS-GEM is restricted.

- Only the user *admin* has full access to the file system of the MBUS-GEM via FTP. The user *ftp* is only allowed to access to the directory *C:/log*.

New users can be added by pressing the button **Add** or using the context menu by right-clicking on the user list.

Figure 14: Input dialog for adding a user

Besides the username and the password of the new user it is possible to define how many login sessions in parallel are allowed for this user (-1 means no limit). Besides of the user *admin* one further user account can have FTP access to the MBUS-GEM. FTP access is restricted to the log data of the MBUS-GEM (directory *C:/log*). This property can only be set upon creation of a user account.

- A separate FTP user (e. g.: *ftp*) makes it possible to retrieve all stored log data through a remote client (manual or automated) without affecting access to any other services or data of the MBUS-GEM.

An already created user can be edited by double-clicking on its user entry or by selecting the context menu entry **Edit**. The user edit dialog is equal to the user create dialog. To reset the password of a user the checkbox "Set Password" needs to be selected. If this checkbox is not selected the password will not be changed or resetted. It is not possible to display an already set password.

The configuration can be completed by pressing the button **Ok** or can be cancelled by pressing the button **Cancel**.

By pressing the button **Delete** or by clicking on the correspondent context menu entry a user entry with exception of the user *admin* can be deleted.

The button **Save** finally saves the configuration.

4.8 Print page

For a print preview or for an export of the MBUS-GEM configuration the print page can be used which is called by pressing the button **Print** (bottom right). According to the access rights the website is generating an additional view that contains all available configured parameters. The print page will be automatically closed (if not done already) by the logout of the user.

- ✓ The displayed meter list is to be used for inserting within a spreadsheet application.



Figure 15: Print page of the MBUS-GEM

5 Specification Modbus TCP

The Modbus protocol was originally developed by the company Modicon (now Schneider Electric) developed for the communication with their controllers. Data is transmitted in the terms of 16-Bit registers (integer format) or as status information in terms of data bytes. Over the years, the protocol has been continuously expanded. Modbus TCP is one kind of it.

- ➔ Modbus TCP is part of the standard IEC 61158
- ➔ A specification can be found here: www.modbus.org

The Modbus protocol is a single master protocol. This master controls the entire communication and monitors occurring timeouts (no response from the addressed device). The connected devices are only allowed to respond to requests by the master.

The MBUS-GEM is a Modbus TCP server, namely a Modbus TCP slave.

The Modbus communication requires an established TCP connection between a client (i. e.: PC or PLC) and the server (MBUS-GEM). The configured Modbus TCP port in the tab **Server** is used for the communication. This is configured to 502 by default (see section: 4.4).

- ✓ If there is a firewall installed between the server and the client, please make sure that the configured TCP port is available.

5.1 Function codes

Following functions codes are supported by the MBUS-GEM:

Code	Name	Description
0x01	Read Coil	Currently without any functionality
0x03	Read Holding Register	Reading of meter data, register layout see tables section 6.2.2
0x05	Write Single Coil	Currently without any functionality
0x06	Write Single Register	Currently without any functionality
0x10	Write Multiple Register	Currently without any functionality
0x0F	Force Multiple Coil	Currently without any functionality
0x2B	Read Device Identification	Reading of device data by MEI = 0x0E

Table 14: Function codes for Modbus TCP

Function codes marked as “Currently without any functionality” are replied with *ILLEGAL DATA ADDRESS* (0x02), other unsupported codes are replied with *ILLEGAL FUNCTION* (0x01).

If the function codes 0x2B is used along with MEI = 0x03, the device is responding with identification data. The values 0x01 und 0x02 are supported as *Device ID code*, allowing to retrieve basic (*basic device identification*) and regular (*regular device identification*) data. Following data is available in the identification data:

Object ID	Name	Data type	Example	Type
0x00	VendorName	String	solvimus GmbH	Basic
0x01	ProductCode	String	1036	Basic
0x02	MajorMinorRevision	String	001	Basic
0x03	VendorUrl	String	www.solvimus.de	Regular
0x04	ProductName	String	MBUS-GE80M	Regular
0x05	ModelName	String	Standard	Regular
0x06	UserApplicationName	String	Modbus TCP Gateway	Regular

Table 15: Device identification

5.2 Data format

The arrangement of data in the Modbus registers corresponds to the usual structure. It uses the *big endian* representation. Regarding the 16-Bit registers, the higher byte is sent first, then the lower byte thereafter.

Example: value: 0x1234 transmission: 0x12 first, 0x34 afterwards

If number and data ranges go beyond 16 Bits, representation is quite similar. Again, the most significant 16-Bit register is sent first and so it is addressed with the lowest register address.

Example: value: 0x12345678 transmission: 0x12 first, followed by 0x34, 0x56 and 0x78

- ✓ The word order of 32 bit and 64 bit values can be changed within the system configuration file by setting the parameter MODBUS_SWAP (see section 8.4.1).

For checking the data layout on the Modbus master side it is possible to generate dummy data by the MBUS-GEM (see section 4.4). The following data will be represented via the Modbus interface according to the register layout described in section 6.2.2:

Adress	Value	Description	Decoded value
0	0x0002	Serial No. of MBUS-GEM, upper word	0x2993A
1	0x993A	Serial No. of MBUS-GEM, lower word	
2	0x0001	Version of communication protocol used by the MBUS-GEM	1
3	0x006F	Firmware version of the MBUS-GEM	0x6F = 111: Version 1.11
4	0x519C	Timestamp of MBUS-GEM system time, upper word	0x519CC16D = 1369227629: Wednesday, May 22nd 2013, 15:00:29 GMT+2
5	0xC16D	Timestamp of MBUS-GEM system time, lower word	
6	0x0000	Empty field	
7	0x0100	Type field of register set in upper byte	0x01: Gateway entry
8	0x0000	Empty field	
9	0x0000	Empty field	
10	0x00BC	Serial No. of meter, upper word	0xBC614E = 12345678
11	0x614E	Serial No. of meter, lower word	
12	0x0443	3-letter manufacturer Code (see section 6.2.2)	0x0443: ABC
13	0x0102	Version (upper byte) and medium (lowerbyte) of the meter	0x0102: Version 1, medium 2 (electricity)
14	0x519C	Timestamp of the meter, upper word	0x519CC164 = 1369227620: Wednesday, May 22nd 2013, 15:00:20 GMT+2
15	0xC164	Timestamp of the meter, lower word	
16	0x0000	Empty field	
17	0x0200	Type field of register set in upper byte	0x02: Meter entry
18	0x0000	Empty field	
19	0x0000	Empty field	
20	0x0000	Meter value (integer), highest word	0xBC614E = 12345678 Resultierender Zählerwert: 12345678 * 10 ⁻⁴ = 1234.5678 Wh
21	0x0000	Meter value (integer)	
22	0x00BC	Meter value (integer)	
23	0x614E	Meter value (integer), lowest word	
24	0x449A	Meter value (float), upper word	0x449A522B = 1234.567800
25	0x522B	Mater value (float), lower word	
26	0xFFFF	Scaling factor (exponent to base 10)	0xFFFF = -4: factor = 10 ⁻⁴
27	0x0005	Type field of register set in upper byte and unit of value in lower byte(see section 6.2.2)	0x00: Meter value entry 0x05: Wh
28	0x519C	Timestamp of meter value, upper word	0x519CBBB3 = 1369226163: Wednesday, May 22nd 2013, 14:36:03 GMT+2
29	0xBBB3	Timestamp of meter value, lower word	

Table 16: Dummy data

6 Acquisition and processing of meter data

The main task of MBUS-GEM is the processing and transmission of meter data. For proper operation, following issues must be considered:

- The available meters must be configured correctly (meter configuration of MBUS-GEM). Required meters or meter values shall be enabled by the checkbox Active and shall have a valid register address.
- The read out meter data shall be transmittable from the device to a PLC via Modbus TCP.
- The PLC is able to process the meter data (meter data format).

6.1 Meter configuration

Meters are collected by the MBUS-GEM automatically using a scan process. Therefore the meter interfaces must be configured correctly (see section: 4.3).

6.1.1 Scanning for meters

It is possible to search for meter automatically on the M-Bus interface. The meters primary or secondary addresses are used for an iterative scan process. After completion of the scan process all found meters will appear in the meter list.

The scan mode (primary or secondary) can be configured via the tab **Configuration** (see section: 4.3). The search process itself can be initiated from the tab **Meters** (see section: 4.2).

The M-Bus interface allows mixed configurations. I. e. it is possible to scan for primary addresses first and then scan for secondary addresses in a second run. New found meters are appended to the existing list. Meters found in both runs stay in list as-is and remain unchanged if already configured. If a meter is found for the first time during primary search, the primary address is used for all further requests. This applies also to secondary search and secondary addressing.

- ✓ The M-bus supports the primary and secondary address for accessing the meter. Secondary addressing is recommended if the meters should be recognized and read out without additional configuration. However, the read-out process takes longer compared to primary addressing. If all meters are pre-configured with a unique primary address, it is recommended to use primary addressing, and may be narrow down the limits for the primary addresses according to the expected values. The big advantage of primary addressing is that meters of exactly the same type and configuration (with an altered serial number) can be exchanged directly in the case of maintenance without adjustments at the MBUS-GEM.
- ➔ Automated allocation of the primary addresses or setting of parameters/registers of meters by the MBUS-GEM is available on request.

6.1.2 Configure meters directly

Meters that are connected to the M-Bus interface of the MBUS-GEM and that are not found automatically during a scan can be add manually at the tab **Meter** by pressing the button **Add** or by using the context menu entry **Add Meter**. The meter's configuration must be known to accomplish this task.

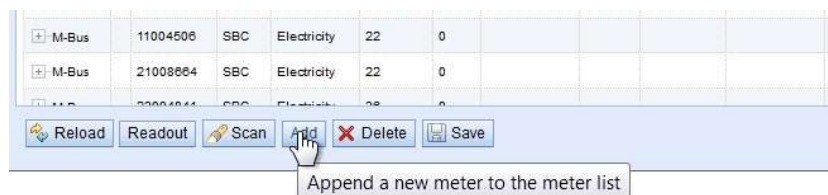


Figure 16: Adding a meter manually at the tab Meter

Figure 17: Input dialog for manually adding a meter

All fields are correspondent to the fields at the meter list view (see Table 7: Fields in tab Meter). It is possible to configure the serial number, the interface to which the meter is connected to, the 3-letter manufacturer code (see DLMS user association), the media and the version manually.

Additionally there is a parameter called **Number of meters** which makes it possible to create more than one meter. The configuration can be confirmed with the button **Ok** or cancelled with the button **Cancel**.

After creating a meter and saving the new meter configuration, the new meter will be read out using the global configured readout cycle.

6.2 Format of meter data

The meter data can be transferred via a Modbus TCP connection.

6.2.1 Predefined types for media, measurements and units

The medium types and units used within the meter data are pre-defined in the standard EN 13757-3.

Following table shows the pre-defined values for the media ID:

Index	Description
0	Other
1	Oil
2	Electricity
3	Gas
4	Heat (outlet)
5	Steam
6	Warm water
7	Water
8	Heat cost allocator
9	Compressed air
10	Cooling (outlet)
11	Cooling (inlet)
12	Heat (inlet)
13	Combined heat / cooling
14	Bus / System component
15	Unknown medium
16 - 19	Reserved
20	Calorific value
21	Hot water
22	Cold water
23	Dual register (hot/cold) water
24	Pressure
25	A/D Converter
26	Smoke detector
27	Room sensor
28	Gas detector
29 - 31	Reserved
32	Breaker (electricity)
33	Valve (gas or water)

Index	Description
34 - 36	Reserved
37	Customer unit
38 - 39	Reserved
40	Waste water
41	Waste
42	Carbon dioxide
43 - 48	Reserved
49	Communication controller
50	Unidirectional repeater
51	Bidirectional repeater
52 - 53	Reserved
54	Radio converter (system side)
55	Radio converter (meter side)
56 - 255	Reserved

Table 17: Medium types

The following table lists the predefined measurement types (descriptions of measurement value). In addition, own text-based measurement types can also be configured depending on the meter interface (indicated by index 31):

Index	Description
0	None
1	Error flags (Device type specific)
2	Digital output
3	Special supplier information
4	Credit
5	Debit
6	Volts
7	Ampere
8	Reserved
9	Energy
10	Volume
11	Mass
12	Operating time
13	On time
14	Power
15	Volume flow
16	Volume flow ext
17	Mass flow
18	Return temperature
19	Flow temperature
20	Temperature difference
21	External temperature
22	Pressure
23	Timestamp
24	Time
25	Units for H. C. A.
26	Averaging duration
27	Actuality duration
28	Identification
29	Fabrication
30	Address
31	Meter specific description (text based)
32	Digital input
33	Software version
34	Access number
35	Device type
36	Manufacturer
37	Parameter set identification
38	Model / Version
39	Hardware version
40	Metrology (firmware) version
41	Customer location
42	Customer
43	Access code user
44	Access code operator
45	Access code system operator
46	Access code developer
47	Password
48	Error mask
49	Baud rate
50	Response delay time
51	Retry
52	Remote control (device specific)

Index	Description
53	First storagenum. for cyclic storage
54	Last storagenum. for cyclic storage
55	Size of storage block
56	Storage interval
57	Vendor specific data
58	Time point
59	Duration since last readout
60	Start of tariff
61	Duration of tariff
62	Period of tariff
63	No VIF
64	wM-Bus data container
65	Data transmit interval
66	Reset counter
67	Cumulation counter
68	Control signal
69	Day of week
70	Week number
71	Time point of day change
72	State of parameter activation
73	Duration since last cumulation
74	Operating time battery
75	Battery change
76	RSSI
77	Day light saving
78	Listening window management
79	Remaining battery life time
80	Stop counter
81	Vendor specific data container
82	Reactive energy
83	Reactive power
84	Relative humidity
85	Phase voltage to voltage
86	Phase voltage to current
87	Frequency
88	Cold/Warm Temperature limit
89	Cumulative count max. power
90 - 255	Reserved

Table 18: Measurement types

The following table lists the predefined units. In addition, own units can also be configured, depending on the meter interface:





Index	Unit	Description
0	None	None
1	Bin	Binary
2	Cur	Local currency units
3	V	Volt
4	A	Ampere
5	Wh	Watt hour
6	J	Joule
7	m ³	Cubic meter
8	kg	Kilogram
9	s	Second
10	min	Minute
11	h	Hour
12	d	Day
13	W	Watt
14	J/h	Joule per Hour
15	m ³ /h	Cubic meter per hour
16	m ³ /min	Cubic meter per minute
17	m ³ /s	Cubic meter per second
18	kg/h	Kilogram per hour
19	Degree C	Degree celsius
20	K	Kelvin
21	Bar	Bar
22		Dimensionless
23 - 24	Res	Reserved
25	UTC	UTC
26	bd	Baud
27	bt	Bit time
28	mon	Month
29	y	Year
30		Day of week

Index	Unit	Description
31	dBm	dBm
32	Bin	Bin
33	Bin	Bin
34	kVARh	Kilo voltampere reactive hour
35	kVAR	Kilo voltampere reactive
36	cal	Calorie
37	%	Percent
38	ft ³	Cubic feet
39	Degree	Degree
40	Hz	Hertz
41	kBTU	Kilo british thermal unit
42	mBTU/s	Milli british thermal unit per second
43	US gal	US gallon
44	US gal/s	US gallon per second
45	US gal/min	US gallon per minute
46	US gal/h	US gallon per hour
47	Degree F	Degree Fahrenheit
48 - 255	Res	Reserved

Table 19: Units

6.2.2 Modbus register layout

This chapter describes the Modbus register specification. The MBUS-GEM uses a fixed address structure of 10 Modbus registers each.

-  Addresses for registers are enumerated starting with 0.
-  Data types using more than one register are encoded with the most significant word at the lowest address.
-  The function code 0x03 (Read holding register) is used for reading the data.
-  Within the Modbus protocol, there is only data formatted as integer or float. Other data types used on M-Bus (i. e.: BCD) are converted to integer values before transmission.

The first 10 Modbus register starting at address 0 are status registers of the MBUS-GEM and are defined as follows:

Address	Name	Data length	Descriptions / notes
0 - 1	Serial number	32 Bit	Serial number of MBUS-GEM as hexadecimal numbers
2	Protocol version	16 Bit	Protocol version for Modbus interface (value=1)
3	Version	16 Bit	Software version of the gateway (as integer)
4 - 5	Time stamp	32 Bit	Unix time stamp of last read-out, system time of the gateway shall be set correctly (manually or via SNTP)
6	Reserved		Reserved
7	Type field / reserved	16 Bit	Type field for register set in the upper Byte (value=1 for gateway entry), lower byte is reserved
8 - 9	Reserved		Reserved

Table 20: Modbus registers for the MBUS-GEM

Each meter is characterized by 10 Modbus registers. Their offset has to be added to the starting register address for each meter. They are defined as follows:

Offset	Name	Data length	Descriptions / notes
0 - 1	Serial number	32 Bit	Serial number of meter as integer value (not as BCD), only decimal numbers are allowed
2	Manufacturer ID	16 Bit	Encoding of manufacturer by using different blocks of Bits: Bits 10 - 14: first character, Bits 5 - 9: second character and Bits 0 - 4: third character, the particular values point to the three letters, counting from "A" with value 1
3	Version / medium	16 Bit	Version of meter in the upper Byte and the medium ID in the lower Byte of the register according to Table 17: Medium types, it holds the index number
4 - 5	Time stamp	32 Bit	Unix time stamp of last meter read-out, system time of the gateway shall be set correctly (manually or via SNTP)
6	Reserved		Reserved
7	Type field / reserved	16 Bit	Type field for register set in the upper Byte (value=2 for meter entry), lower byte is reserved
8	Flags	16 Bit	Bit 0: Value 1: Meter could not be read, Value 0: Meter could be read correctly Bit 1: Value 1: Not all meter values are updated, Value 0: All meter values updated Bit 2-15: Reserved
9	Reserved		Reserved

Table 21: Modbus registers for a meter

Each meter value is characterized by 10 Modbus registers. Their offset has to be added to the starting register address for each meter value. They are defined as follows:

Offset	Name	Data length	Descriptions / notes
0 - 3	Meter value	64 Bit	Signed integer value (not scaled)
4 - 5	Meter value	32 Bit	Floating point value (scaled to unit in register 7), IEEE 754
6	Scale factor	16 Bit	Signed scale factor (exponent to the power of 10)
7	Type field / unit	16 Bit	Type field for register set in the upper Byte (value=0 for meter value entry), the lower byte encodes the unit according to Table 19: Units, it holds the index number
8 - 9	Time stamp	32 Bit	Unix time stamp transmitted by the meter, if there are no time stamps transmitted by the meter, this value is set to 0

Table 22: Modbus registers for a meter entry

The following figure shows an example for a configuration of Modbus addresses via the website:

<input checked="" type="checkbox"/> MBus	66600106	LUG	Heat (outlet)	2					10	<input checked="" type="checkbox"/>
---					4	1e+0	s	Actuality Duration	0	<input type="checkbox"/>
---					4	1e+0	s	Averaging Duration	0	<input type="checkbox"/>
---					267	1e+3	Wh	Energy	20	<input checked="" type="checkbox"/>
---					372876	1e-2	m^3	Volume	0	<input type="checkbox"/>
---					0	1e+2	W	Power	0	<input type="checkbox"/>

Figure 18: Modbus registers configured via the website

Regarding this example, following data is transmitted to the Modbus master:

Address	Value	Name	Decoded value
Gateway entry			
0	0x0002	Serial number	0x0002993A
1	0x993A		
2	0x0001	Protocol version	1
3	0x006F	Version	Version = 0x006F = 111 → v1.11
4	0x519C	Time stamp	0x519CC16D = 1369227629 =
5	0xC16D		Wednesday, 2013-05-22, 15:00:29 GMT+2
6	0x0000	Reserved	
7	0x0100	Type field / reserved	Type = 1 → gateway entry
8	0x0000	Reserved	
9	0x0000		
Meter entry			
10	0x03F8	Serial number	0x03F83CAA = 66600106
11	0x3CAA		
12	0x32A7	Manufacturer ID	0x32A7 = '0011.0010.1010.0111' 1st letter: '_011.00_._._._' → 0x0C = 12 → L 2nd letter: '_._._.10.101_._._' → 0x15 = 21 → U 3rd letter: '_._._._.0.0111' → 0x07 = 7 → G
13	0x0204	Version / medium	Version = 2 Medium = 4 = Heat (outlet)
14	0x519C	Time stamp	0x519CC16D = 1369227629 =
15	0xC16D		Wednesday, 2013-05-22, 15:00:29 GMT+2
16	0x0000	Reserved	
17	0x0200	Type field / reserved	Type = 2 → meter entry
18	0x0000	Reserved	
19	0x0000		
Meter value entry			
20	0x0000	Meter value (integer)	0x000000000000010B = 267
21	0x0000		Resulting value: 267 * 10 ³ Wh
22	0x0000		
23	0x010B		
24	0x4882	Meter value (floating point)	0x48825F00 = 267000.000000 Wh
25	0x5F00		
26	0x0003	Scale factor	Factor = 10 ³
27	0x0005	Type field / unit	Type = 0 → meter value entry Unit = 5 → Wh
28	0x519C	Time stamp	0x519CBBB3 = 1369226163 =
29	0xBBB3		Wednesday, 2013-05-22, 14:36:03 GMT+2

Table 23: Example for data in Modbus registers

7 Troubleshooting

In case the MBUS-GEM works not as described in this document, it is useful to locate the malfunction in order to resolve the issue and to recover the full functionality again.

7.1 Hardware errors

7.1.1 The device does not respond.

After powering the device it does not operate. Current consumption is about 0 mA and both Ethernet LEDs stay dark.

Please check the power supply:

- Is there a voltage of about 24 VDC between the terminals 24VDC and GND?
- Does the power supply have the correct polarity?

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.1.2 Current consumption is too high

After powering the device, the current consumption rises above 500 mA.

Please check the M-Bus connection:

- Is there a voltage of about 36 VDC between the terminals MBUS+ and MBUS-?
- Disconnect the device from the M-Bus. Is the current consumption at a normal level again?
Please measure the 36 VDC again.
- Are the Ethernet LEDs blinking somehow?

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.2 Network error

7.2.1 No network connection

If there is no network connection to the MBUS-GEM, first run a ping connection test (see section: 3.1.2).

If no ping reply is received and if the MBUS-GEM is connected via a larger network, test the MBUS-GEM once more with a direct network connection to a PC. Depending on the remote network node, a cross-over cable must be used for a direct connection between the PC and the MBUS-GEM.

Check the physical network connection between the PC and the MBUS-GEM. Cables shall be properly connected and plugged.

At the network port of the MBUS-GEM, the link LED should light amber continuously and the active LED should flash green sometimes. Please check also the corresponding LEDs on the remote terminal (PC, hub, etc.). If necessary, retry with other cables.

If all LEDs light correctly, please check if the MBUS-GEM is shown the CHIPtool (see section: 3.1). The MBUS-GEM must therefore be connected with the PC via a local area network.

If the wanted MBUS-GEM does not appear in the list (the serial number should correlate), please make sure that the communication is not suppressed by a firewall.

If the wanted MBUS-GEM appears in the list, please configure a unique IP address that is available on the local network (see section: 3.1.1). Please contact your network administrator.

Using a direct connection between the PC and network following example configuration can be used if there are no other devices connected to the network:

PC	
IP	192.168.1.10
Network mask	255.255.255.0
MBUS-GEM	
IP	192.168.1.101
Network mask	255.255.255.0

Table 24: Example for IP address configuration

If access errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.2.2 The MBUS-GEM cannot be accessed via website or FTP

If it is not possible to access the MBUS-GEM with your browser, you should perform a Ping connection test (see section: 3.1.2) first. On a test basis you may also log in via FTP (see section: 3.1.4). If there is no network communication with the MBUS-GEM in general, please have a look at section 7.2.1.

If a particular web service is not available, please check passwords and also firewall settings on your PC or in your network.

If the website appears but it is not possible to log in, please check whether you can log in with *admin* credentials. Please clean up browser cache and reload the web page (i. e.: <F5> or <CTRL + F5>).

If access errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.2.3 User does not have write access to the website

Please check if the user is configured having write access (configuration in tab **User**).

Write access is only available for one user at a time. If other users are simultaneously logged on MBUS-GEM (tab **User**, column Sessions), log them out first or wait until they are logged out. Please check whether any other session is active, i. e. on another browser page (tab).

Maybe a previous user session was not closed or logged out properly. Please wait for the connection timeout of approximately 30 seconds and then log in again.

 It is recommended to always terminate a user session with the logout button.

Also log in with *admin* credentials and check for write access.

If access errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.2.4 The web session is terminated unexpectedly

If the web session with the MBUS-GEM is terminated unexpectedly, this may be due to a connection timeout. The timeout parameter can manually be configured by the parameters *WEBCOM_TIMEOUT* (see section: 8.4.1).

A timeout may also occur if the MBUS-GEM is currently busy, the collection and transmission of meter data takes priority over web communication.

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.2.5 FTP login fails

If the FTP login is not working or there are no files in the listing, login with the *admin* credentials first. Make sure that the administrator password is correct. You may check this by logging in as *admin* on the website.

If the login was successful (i. e.: no error in communication log) but no file listing occurs, please activate the FTP passive mode in your FTP client. In CHIPtool this mode can be activated directly in the FTP log-in dialog. Please make also sure that the additional built-up FTP data connection for the file transfer or the file listing is not suppressed by an existing firewall.

If access errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.3 Error in meter reading

7.3.1 M-Bus meters cannot be read out

Please check the cable between the MBUS-GEM and the meter and replace faulty cables. If the MBUS-GEM is working, please measure the M-Bus voltage (approximately 36 V) between the two M-Bus lines at the MBUS-GEM and also at the meter.

Please make sure that the M-Bus interface (**M-Bus mode**) on the website in the tab **Configuration** is enabled and the meters support configured search mode (primary or secondary).

Please try searching for meters gradually by limiting address space (i. e.: **Primary start address**) or by using a search mask (i. e.: **Secondary address mask**).

Additionally the M-Bus request can be altered with the following parameters:

- M-Bus request mode
- M-Bus reset mode

Please perform another scan with a different baud rate (300, 2400 or 9600) or increase the timeouts respectively.

If possible, please remove other meters to eliminate a possible source of error.

If available, please connect another M-Bus meter and repeat the communication test with this meter in order to locate the source of error.

Within the internal configuration of the MBUS-GEM the parameter MAXRETRY is used to increase the number of attempts of a single M-Bus request.

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.3.2 Not all meters can be found

Please do work with search masks or by limit the address space to perform a gradual scan of the M-Bus.

Also perform a scan as a primary scan as well as a secondary scan. Not every meter supports both methods.

If possible, please remove other meters to eliminate a possible source of error.

If available, please connect another M-Bus meter and repeat the communication test with this meter in order to locate the source of error.

Please increase the parameter MBUS_MAXRETRY (see section: 8.4.1) located in the file A:\chip.ini from the default value. Meters that do not respond to every request will be found easier using this setting. Please perform a new scan.

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.3.3 M-Bus meters are found but do not have any data on the website

Some meters contain an erroneous declaration of the secondary address. This is why these meters are not addressable for meter readouts. The parameter MBUS_SELECTMASK (see section: 8.4.1) of the file A:\chip.ini makes it possible to mask parts of the secondary address. These parts of the

secondary address will be replaced by a wild card. Especially the version field (entry: MBUS_SELECTMASK=4) is a frequent cause of this problem.

Please do start a new scan of the M-Bus.

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.3.4 Scanning takes a lot of time

Under certain circumstances performing a scan on the M-Bus can take a very long time (>1h).

Please do work with search masks or limit the address space to perform a gradual scan of the M-Bus.

Please decrease the value of the parameter *MBUS_MAXRETRY* located in the file *A:\chip.ini* (see cap. 8.4.1).

Please make use of another scan mode on the tab configuration (see section: 4.3) or set the parameter *MBUS_SCANMODE* located in the file *A:\chip.ini* (see section: 8.4.1). Especially the reversed secondary scan (*SECONDARYSCANREVERSE*) can be used to avoid this problem.

Please do start a new scan of the M-Bus.

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.3.5 The device restarts occasionally while performing a scan

The device is equipped with an internal watchdog for safety reasons which shall prevent a denial of service of the device. If a scan takes a very long time a reboot of the device could be triggered by the watchdog. If an M-Bus scan takes a very long time it is useful to increment the value of the parameter *WATCHDOG_SCAN* located in the file *A:\chip.ini* (see section: 8.4.1).

Please do start a new scan of the M-Bus.

Under certain circumstances there can be lots of collision on the M-Bus, for example if all meters are responding at the same time. These collisions and the resulting high current draw of the M-Bus slaves can trigger a reboot of the device in some exceptional cases. Please do work with search masks or limit the address space to perform a gradual scan of the M-Bus. If possible, try to split the bus and scan each bus segment separately.

Please do start a new scan of the M-Bus.

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.3.6 Error message: Capacity of internal webserver exceeded

After a scan or a change at the meter list has been performed the MBUS-GEM (even after a reboot) shows the following error message within the meter list:

The meter list exceeds the capacity of the internal webserver

This error message is caused by an internal limitation of the webserver that prevents a correct transmission of the website. The meter list will be generated in the MBUS-GEM and meter data will be logged and also sent via already configured WAN-interfaces but a configuration on the website is not possible. This could be caused by a large amount of configured meters or long parameter lists of single meters.

For a correct display of the meters the number of displayed meters or the number of values per meter need to be limited.

The following parameters of the tab **Configuration** can be used to set the limitation (see cap. 0):

- Description mode set to Standard or (if not needed) set to None.
- Maximum device count set to the default value of 80 or to a lower value.

- Maximum value count set to the default value of 25 or to a lower value.
- M-Bus request mode set to Standard to deactivate the request of partly extensive additional data of the meter.
- M-Bus max. multipage set to the default value of 3 or lower.

Any change of the parameter *Description Mode* will be valid directly after reinitialization of the MBUS-GEM. All other parameters depend on a generation of the meter list. This task is accomplished by saving an empty meter list and subsequent performing a new scan. Any attempt of saving a meter list that is too large leads to the deletion of the meter list.

Alternatively a manual change of the meter configuration (see section: 8.4.2) instead of the graphical editing on the website is possible. The MBUS-GEM needs to be restarted for changes taking effect. The new meter list can now be processed by the MBUS-GEM and will be forwarded over the MODBUS interface. It is not possible to display the meter list on the website when manual editing is used.

If errors could not be resolved, please contact our customer support:
email: support@solvimus.de

7.4 Error in transmitting meter data

7.4.1 Meter data is not transmitted via Modbus

Please make sure that the parameters for the Modbus communication (IP and port) are set correctly.

If possible, please check the network communication to the remote system using a network protocol analyzer such as Wireshark.

If drive is not available, please contact our customer support:
email: support@solvimus.de

8 Advanced Features

8.1 Software update

In order to provide new features to the MBUS-GEM, there is the possibility to perform a software update.

- ⚠ File integrity shall be ensured previous to an update.
- ⚠ A continuous power supply shall be ensured during an update.

Two steps are needed for an update. In the first step, the operating system (RTOS) on the controller is updated. In the second step the firmware of MBUS-GEM is transferred. In most cases, updating the RTOS is not necessary.

The current version of RTOS and MBUS-GEM software can be found in the tab **Service** on the website (see section: 4.6).

8.1.1 Operating system (RTOS)

It might be necessary to update the RTOS in the future in order to use newer software releases. For updating the RTOS, CHIPtool has to be installed on the PC and the MBUS-GEM shall be listed in the main window (see section: 3). The new RTOS firmware is provided by an image file *SC1x3V0<Version>_FULL.hex* contained in the update files. <Version> represents the RTOS version (i. e.: 154).

The appropriate image file can be selected and transferred via the dialog shown after calling **Program flash image** in the context menu of the MBUS-GEM:

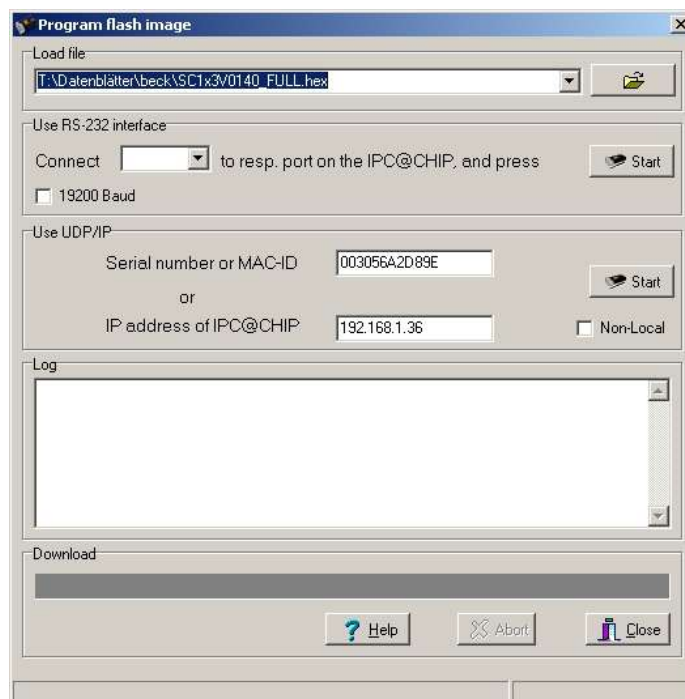


Figure 19: Transferring flash image via CHIPtool

Within this dialog **Load file** points to the image file and the device to be updated is identified in the groupbox **Use UDP/IP**. The button **Start** initiates the RTOS update. The administrator password might be entered.

- ℹ The default password is contained in section 4.7.
- ⚠ Transmitting a flash image to the MBUS-GEM may restrict its functionality. Only trained personnel are allowed to change the files and the file system.
- ⚠ The integrity of the image shall be ensured previous to transferring the image file.
- ⚠ A continuous power supply shall be ensured during transferring the image file.

After transferring the flash image to the MBUS-GEM, it will reboot automatically. After updating the RTOS, the MBUS-GEM is fully functional with the existing configuration.

8.1.2 Application software (firmware)

For updating the firmware of the MBUS-GEM, first unpack the given archive file to an empty directory. Open the website of the MBUS-GEM and log in with *admin* credentials. Check the tab **Service**, whether the button **Reboot** is active (not grayed out).

Now log in via FTP (see section: 8.3) and save all data available on drive A:. After backing up current data replace all files in that directory and its sub directories with the newer ones from the archive file (excluding the file *chip.ini*). Existing configuration files remain unchanged.

Now exit the FTP connection and restart the MBUS-GEM by clicking button **Reboot** on the website.

After rebooting the MBUS-GEM, browser cache should be cleaned up and the web page should be reloaded (i. e.: key <F5> or <CTRL + F5>).

8.2 Administrative Telnet connection

Administrative access to the device can be obtained using a standard Telnet client connecting to the MBUS-GEM with *admin* credentials.

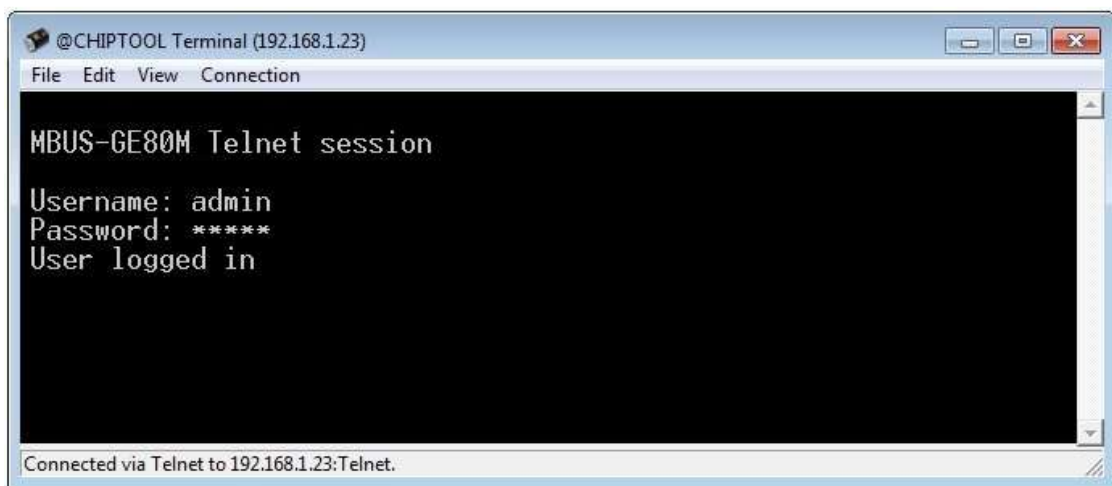


Figure 20: Telnet window of CHIPtool

After logging in, the terminal displays system specific console output according to configuration of the MBUS-GEM.

- ❗ A Telnet connection can be established via the context menu of the CHIPtool (see section: 3.1).
- ❗ The default password is contained in section 4.7.
- ⚠ Only trained personnel are allowed to access the console, since this may restrict the functionality of the device.

8.3 Administrative FTP connection

Exchanging data and files with the MBUS-GEM is directly possible via the internal FTP server. An ordinary FTP client can access the MBUS-GEM using the appropriate IP and log-in credentials.

- ❗ An FTP connection can be established via the context menu of the CHIPtool (see section: 3.1.4).
- ❗ The default password is contained in section 4.7.

After logging in with *admin* credentials, two drives are available. Drive A: contains the system files and drive C: contains the log files.

The additional FTP user only has access to the directory *C:/log*.

- ⚠ Only trained personnel is allowed to change the files and the file system in other directories than C:/log, since this may restrict the functionality of the device.

In directory C:/log, available log data can be downloaded or can be deleted. If the ramdrive (drive C:) is full, older log data is deleted automatically.

Configuration files can be directly changed, saved or restored on drive A: (see section: 8.4).

8.4 Configuration files

Different configuration files are stored in directory A:/ of the MBUS-GEM.

- ⚠ Only trained personnel is allowed to change the files and the file system of the MBUS-GEM, since this may restrict the functionality of the device.
- ⚠ For editing the configuration files please use an UTF8-capable editor otherwise there could be errors when using special characters. Since there is no byte order mark (BOM) included in the configuration file your editor might need to be manually set to UTF8.
- ➔ We recommend using the editor Notepad++ (see <http://notepad-plus-plus.org/>)

8.4.1 System configuration file

The file A:/chip.ini is the main configuration file and contains the general system parameters. The parameters are arranged in different groups. Parameters not explicitly configured in *chip.ini*, are set to their default values.

- ℹ Manual changes to the file chip.ini have no effect until rebooting the MBUS-GEM.
- ℹ The file chip.ini may be transferred to another MBUS-GEM via FTP with respect to the network configuration (i. e.: different IP address).

Parameter*	Description	Valid range	Standard*
Group [IP]			
ADDRESS	IP address of device	0.0.0.0 - 255.255.255.255	Not set
NETMASK	Subnet mask of device	0.0.0.0 - 255.255.255.255	Not set
GATEWAY	IP address of device	0.0.0.0 - 255.255.255.255	Not set
DHCP	Enabling DHCP look-up	0, 1	1
TCPIPMEM	Memory for the webserver in kB	60-1000	280
Group [DEVICE]			
NAME	Name of device shown in CHIPtool	Text, max. 20 characters	MBUS-GE20M / MBUS-GE80M
Group [SOLVIMUS]			
MBUS_BAUDRATE	Baud rate for serial M-Bus communication		2400
MBUS_DATABITS	Data bits for serial M-Bus communication	7, 8	8
MBUS_DEBUGOUT	Enables output of raw data to STDOUT	0, 1	0
MBUS_ENABLE	Enables M-Bus interface	0, 1	1
MBUS_FREEZE STORAGEENUM	Storage number for meter data on Freeze command	0 - 4294967295	0
MBUS_FULTIMEOUT	Maximum timeout for reading a meter (in ms).	0-65535	10000
MBUS_IDLETIMEOUT	Idle timeout for detecting end of communication.	0-65535	100
MBUS_MAXMULTIPAGE	Limits number of pages for multipage request	0 - 255	10
MBUS_MAXPRIMARY ADDRESS	Upper limit of address range for M-Bus primary scan	0 - 250	250
MBUS_MAXRETRY	Number of retries for a M-Bus or multipage request	0 - 255	3
MBUS_MINPRIMARY ADDRESS	Lower limit of address range for M-Bus primary scan	0 - 250	0
MBUS_PARITY	M-Bus parity: 0: no, 1: odd, 2: even, 3: mark, 4: space	0 - 4	2
MBUS_RAWLOGENABLE	Enables raw data log to drive B:	0, 1	0

Parameter*	Description	Valid range	Standard*
MBUS_REQUESTMODE	Defines request sequence for read-out	DEFAULT, EXT, ONLY, FREEZE	DEFAULT
MBUS_RESETDISABLE	Disables reset command	0, 1	0
MBUS_RESETMODE	Reset mode: 0: Reset after select, 1: Reset prior to select 2: No reset	0 - 2	0
MBUS_SCANMODE	Scan mode for M-Bus	PRIMARYSCAN, SECONDARYSCAN, SECONDARYSCANALLOC, SECONDARYSCANREVERSE, SECONDARYSCANALLOCREVERSE	SECONDARYSCAN
MBUS_SECMASK MANUFACTURER	Predefined manufacturer ID for secondary scan	Exactly 4 characters, 0-9 each or 0xFFFF	0xFFFF
MBUS_SECMASKMEDIUM	Predefined medium ID for secondary scan	Exactly 2 characters, 0-9 each or 0xFFFF	0xFF
MBUS_SECMASKSERIAL	Mask for serial number of meters for secondary scan	Exactly 8 characters, 0-9 or 0xF each	0xFFFFFFFF
MBUS_SECMASKVERSION	Predefined version number for secondary scan	Exactly 2 characters, 0-9 each or 0xFFFF	0xFF
MBUS_SELECTMASK	Disables parts of secondary address for exact selection, wildcards are used instead (set via bit mask): +1: Serial number +2: Manufacturer +4: Version +8: Medium	0 - 15,	0
MBUS_STOPBITS	Stop bits for serial M-Bus communication	1, 2	1
MBUS_TIMEOUT	Timeout for M-Bus (in ms)	0 - 65535	2000
MBUS_WAKEUPENABLE	Enables specific wake-up request	0, 1	0
METER_MAXALL VALUECOUNT	Limits the total number of meter values (0: no limit)	0 - 65535	0
METER_MAXDEVICE COUNT	Limits the number of meters (0: no limit)	0 - 65535	0
METER_MAXVALUE COUNT	Limits the number of meter values per meter (0: no limit)	0 - 65535	0
METER_STAT_CONFIG	Path for meter configuration file	Text, max. 40 characters	A:\device_ handle.cfg
METER_TIME	Interval for meter read-out (in s), huge amount of data may arise on short cycle times and with many meters	10 - 4294967295	900
MODBUS_DEBUGOUT	Enables the debug output of Modbus data.	0, 1	0
MODBUS_ENABLE	Enables the Modbus slaves	0, 1	0
MODBUS_NWPORT	Network port of the Modbus slave	0 - 65535	502
MUC_CONFIG_VER	Version of configuration file	1, 2	2 (explicit)
MUC_LOG	Sets the level for output of system data to STDOUT	DEFAULT, NONE, ERRORONLY, ALL	DEFAULT
MUC_METERDESCRIPTION _ENABLEFLAGS	Enable flags that control the display of the description field in the meter view: Bit 0: Description Bit1: Storage-number, tariff, value type Bit2: DIF/VIF raw data Bit 3: Complete raw data of meter value entry	0-16	1
MUC_SETDEVICES	Activates writing of meter values	S0, ALL, NONE	S0
MUC_PROTOCOL_VERMU C_SHOWTIMESTAMPENTRIES	Protocol version for CSV and XML dataExplicit display of the meter timestamp.	0, 1, 2, 3	30
MUC_USE_FREEZE	Enables using the Freeze command prior to meter read-out	0, 1	0
SNTP_ENABLE	Enables obtaining system time via SNTP	0, 1	1
SNTP_IP	Address of time server (SNTP)	Text, max. 40 characters	ptbtime1.ptb.de
WATCHDOG_IDLE	Timeout for watchdog during idle state (in s)	1 - 4294967295	120
WATCHDOG_PROCESS	Timeout for watchdog during busy state (in s)	1 - 4294967295	900

Parameter*	Description	Valid range	Standard*
WATCHDOG_READOUT	Timeout for watchdog during read-out (in s)	1 - 4294967295	4 times the read-out cycle, at least: WATCHDOG_PROCESS
WATCHDOG_SCAN	Timeout for watchdog during scan process (in s)	1 - 4294967295	1800
WEBCOM_TIMEOUT	Timeout for a web session, user is logged out automatically after that period (in ms)	1 - 4294967295	30000

*Names of configuration parameters or values are wrapped without a hyphen.

Table 25: Parameters in file chip.ini

- Additional parameters are provided by the RTOS. An overview can be found at:
<http://www.beck-ipc.com/files/api/scxxx/config.htm>

8.4.2 Meter configuration file

Meter configuration is stored in file `A:/device_handle.cfg`. If this file does not exist, it might be created or changed using the tab **Meter** on the website. Only entries which differ from the default values are stored (except entry version).

- Manual changes to the file `device_handle.cfg` take have no effect until rebooting the MBUS-GEM.
- The file `device_handle.cfg` may be transferred to another MBUS-GEM via FTP.

The file uses XML format has following structure:

Parent element	Element	Description	Standard	Example
	version	Version of XML specification	-	0x06
	meter	Parent element for each meter	-	-
meter	interface	Interface to meter	-	M-Bus
meter	serial	Serial number of meter, leading "0x"	0xFFFFFFFF	0x30101198
meter	manufacturer	Manufacturer of meter (abbreviation)	Not set	SLV
meter	version	Version of meter	Not set	0x01
meter	medium	Medium of meter, according to column 2 in Table 17: Medium types in section 6.2.1	Not set	Electricity
meter	primaryaddress	Primary address of meter (M-Bus or S0)	0	0x03
meter	addressmode	Used mode for addressing 0: Secondary, 1: Primary	0	0
meter	readoutcycle	Specific read-out interval (in s)	0	900
meter	maxvaluecount	Limit for number of meter values	0	12
meter	encryptionkey	Encryption key for meter, i. e.: AES for wM-Bus	Not set, 0	0x82 0xB0 0x55 0x11 0x91 0xF5 0x1D 0x66 0xEF 0xCD 0xAB 0x89 0x67 0x45 0x23 0x01
meter	active	Enables logging of meter data or transmission via WAN interface	1	1
meter	rsi	Received Signal Strength Indicator at last reception (wM-Bus)	0	123
meter	register	Allocated Modbus register	0	20
meter	value	Parent element for each value of the meter	-	-
value	description	Description of value, according to column 2 of Table 18: Measurement types in section 6.2.1	None	Energy
value	unit	Unit of value, according to column 2 of Table 19: Units in section 6.2.1	None	Wh
value	encodetype	Coding of value	NODATA	INT32
value	scale	Scale factor (scientific notation)	1e0	1e-3
value	valuetype	Type of value: instantaneous, maximum, minimum, errorstate	instantaneous	instantaneous
value	storagenum	Storage number of value	0	2
value	tariff	Tariff information for value	0	3
value	confdata	Generic data, OBIS code for value (X-X:X.X.X*X; X=0..255; according to column OBIS-ID in tab Meter)	Not set	0x01 0x00 0x01 0x08 0x00 0xFF

Parent element	Element	Description	Standard	Example
value	active	Enables logging of value data or transmission via WAN interface	1	1
value	register	Allocated Modbus register	0	30
value	user	User specific text (according to column User label in tab Meter)	Not set	OG-1-Re

Table 26: Structure of device_handle.cfg

9 Technical data

9.1 General characteristics

9.1.1 Physical dimensions / weight

The housing has following dimensions:

- Width: 35 mm
- Height: 89 mm
- Depth: 58 mm
- Weight: approx. 80g

9.1.2 Installation

The device is intended for installation in a switch cabinet:

- Operating temperature: 0 – 50 °C
- Humidity: 10 – 95 %relH
- Protection class: IP20
- DIN rail mounting (DIN rail 35 mm)

9.1.3 Customs declaration

- TARIC: 85176200

9.2 Electrical characteristics

9.2.1 Power supply

The device is powered externally (pin assignment according to section 2.2):

- Input voltage: 24 V(DC) \pm 5 %, screw clamps ($\leq 2,5 \text{ mm}^2$)
- Power consumption: 2 W (idle state), max. 10 W
- Safety: reverse polarity protection, overvoltage protection (transients)

9.2.2 Meter interfaces

There is an M-Bus interface at the device (pin assignment according to section 2.2):

- Compliant to EN 13757-2, U_{space} = 36 V, U_{mark} = 24 V, screw clamps ($\leq 2,5 \text{ mm}^2$)
- Max. 20 unit loads (UL) for MBUS GE20M, max. 80 unit loads (UL) for MBUS GE80M
- Max. continuous current load: 140 mA
- Max. baud rate of 38400 bps

9.2.3 Communication interfaces

There is one communication interface at the device (pin assignment according to section 2.2):

- Ethernet: compliant to IEEE 802.3
- 100 Base-TX
- RJ45 connector

9.2.4 Galvanic isolation

The Ethernet interface is galvanically isolated from the supply voltage:

- Galvanic isolation: 1000 V

9.3 Further characteristics

9.3.1 Processing unit

There is a microprocessor within the device:

- Core: 80x86 architecture, 96 MHz clock frequency
- Memory: 8 MB RAM, 8 MB Flash (internal)
- Operating system: proprietary RTOS